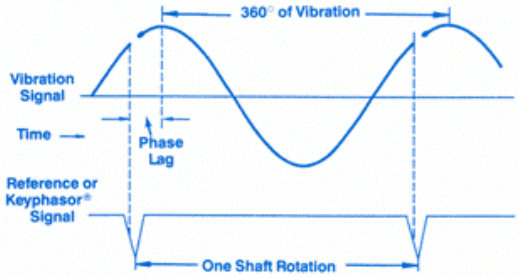
Where should a Keyphasor® transducer be mounted?

by Larry Covino
Design and Installation Services Manager
Bently Nevada Corporation
Buffalo, New York

Accurate, consistent information is essential for proper machinery monitoring and diagnostics. Consistent phase information, before and after outages, is also necessary to evaluate the efficiency of the machine overhaul. (Please see the definition of phase lag angle and absolute phase in the sidebar on page 27.)

When instrumenting machine trains for proper machinery protection, two common errors are made: 1) too few Keyphasor transducers, and 2) incorrect placement of the Keyphasor transducers. Proper location of Keyphasor transducers and reference markers (notches or projections) eliminates many potential pitfalls and helps provide good diagnostic information.

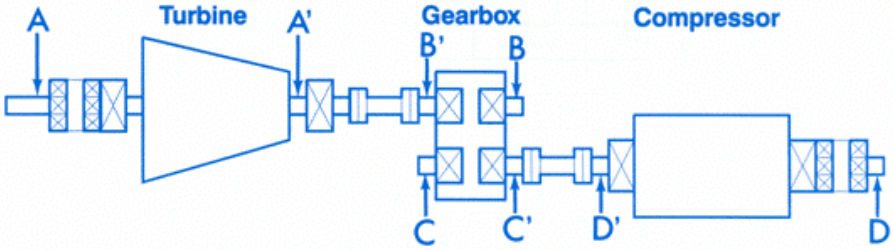
The following is a list of general rules for proper Keyphasor transducer location. Refer to Figure 2.



NOTE: Vibration frequency must be the same or harmonically related to shaft rotative frequency.

Figure 1

- Each machine train component must have a Keyphasor transducer since it is often necessary to run drivers and gearboxes uncoupled from their loads.
- The driver (turbine or motor) must have a Keyphasor transducer, and it must view a notch or projection (event) integral to the driver rotor, not the coupling or a coupled component.
- Gearboxes and fluid drivers should have a Keyphasor transducer on each rotor element. These Keyphasor transducers must also view an event integral to the gearbox or fluid drive rotor, not the coupling or a coupled component.
- Load or driven components must have a Keyphasor transducer, and it must view an event integral to the driven rotor, not the coupling or a coupled component.



A Location of driver Keyphasor transducer
A' Alternate location of driver Keyphasor transducer
B Location of input gear Keyphasor transducer
B' Alternate location of input gear Keyphasor transducer
C Location of output gear Keyphasor transducer
C' Alternate location of output gear Keyphasor transducer
D Location of load Keyphasor transducer
D' Alternate location of load Keyphasor transducer
Alternates are used when the primary area is physically limited.
The operating parameters of the machine components must be considered when locating transducers.

Figure 2
Machine Train Overview

- When reference markers are located on nonintegral rotor components, such as couplings, stub shafts, jack shafts and shrink-on-collars, phase information may be jeopardized due to rearrangement of the rotor components during reassembly after an outage. Locate these reference markers on shafts or their integral components.
- A Keyphasor transducer should be located as close to the thrust bearing area as possible to minimize thermal growth effects which could move the reference markers out of view of the transducer.
- Because notches are stress concentrators, they should not be located in high torque areas, such as at coupling hubs or flanges.
- Notches or projections should be "designed" into the machine. The design should include proper internal radiuses, with the width, depth or height and length based on transducer type, rotative speed and rotor size. They should be lined up with the #1 balance hole, 0° on the balance ring, or some other obvious feature of the shaft. See Figure 3.
- Keyphasor transducers should be located in a radial plane at the same angular orientation as the vertical vibration transducer whenever possible. An axial Keyphasor transducer is not recommended and should never double as a thrust position transducer.
- Installations that will use data acquisition systems, such as Bently Nevada's Dynamic Data Manager® 2, Transient Data Manager® 2, Transient Data Interface External or ADRE® for Windows, should have redundant Keyphasor transducers located at the same angular orientation.
- Keyphasor transducer locations and notch locations should be properly documented. Accurate documentation is critical to the proper use and configuration of diagnostic instruments.

Bently Nevada can assist you with your rotating machinery and system installation needs. We offer a complete range of services — from technical consulting to complete Design and Installation Services. Contact your nearest Bently Nevada sales office for assistance. ■

Absolute phase - the timing relationship, in degrees, between two signals of the same frequency, when one signal, the reference, is fixed in time or shaft rotation; e.g. a Keyphasor pulse, the reference, only occurs when the shaft notch or keyway passes the Keyphasor transducer.

Phase lag angle - the timing relationship, in degrees, between a Keyphasor pulse and the next positive peak of a vibration signal of the same frequency. ■

Typical Notch

Rotor diameter is 152 mm (6 inches)
Rotation: CCW
Location: Driver rotor outboard of thrust bearing in line with 0 degrees on balance ring.
Length: 15 mm (0.6 inches)
Width: approx. 9.5 to 13 mm (0.375 to 0.5 inches)
Depth: 1.5 to 2.5 mm (0.06 to 0.1 inches)
Radius: approx. 9.5 mm (0.375 inch)
Transducer: 8 mm proximity probe
Setup: Gap at 1.3 mm (0.05 inches) away from the rotor - not viewing notch
Machining Method: 19 mm (0.750 inch) ball end, mill to suggested depth will determine width.

Typical Projection (see note below)

Rotor diameter = 152 mm (6 inches)
Rotation: CCW
Location: Driver rotor outboard of thrust bearing in line with 0 degrees on balance ring.
Length: 19 mm (0.75 inches)
Width: 6.4 mm (0.25 inches)
Height: 5 mm (0.2 inches) above rotor surface
Transducer: 8 mm proximity probe
Setup: Gap at 6.4 mm (0.25 inches) away from the rotor - not viewing projection
Machining Method: Fabricate projection. Secure to rotor in a positive fashion. This is to be accomplished on an "as designed" basis and will vary by application.

Note: *Extreme care must be taken to eliminate safety concerns from potential loose parts.*

Figure 3
Keyphasor Notch/Projection